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RACIAL DIFFERENCES IN PALM AND SOLE CONFIGURATIONS

II.—PALM AND SOLE PRINTS OF LIBERIAN NATIVES

BY HARRIS HAWTHORNE WILDER

I. INTRODUCTION

WHEN, about ten years ago, my early studies of human palm and sole prints began to reveal the great individual differences in the configuration of the palmar and plantar friction ridges, there naturally suggested itself the hope that differences, sufficiently distinctive to serve as racial criteria, could be found in the representatives of the different human races. My first observations along this line were made, naturally, upon American negroes, by the help of a set of prints collected at Providence, R. I., by Miss Inez Whipple (Mrs H. H. Wilder); soon after which came the unusual opportunity of studying prints of the Maya-Quichis, afforded me through the kindness of Dr A. M. Tozzer of Harvard University, who collected them during his first visit to Yucatan. The results of those studies, which, to a very limited extent, afforded an opportunity for the comparison of three distinct human varieties, were published in the *American Anthropologist* for April-June, 1904, and yielded fairly satisfactory results. The next work on this subject was that of Schlaginhaufen,¹ on the people of Farther India, and this was followed by a paper by Loth² on Poles from the vicinity of Warsaw. So far as I am able to learn, this completes the literature on the subject.

In my first paper, even with the small collection of prints at my disposal, certain rather definite results were obtained, such as the high percentage of occurrence of the thenar pattern in Maya

¹ Schlaginhaufen, O., *Zur Morphologie der Palma und Planta der Vorderer und Ceyloner*, *Zeitschr. für Ethnologie*, Hefte 3-4, 1906.

² Loth, Edouard, *Anthropologische Untersuchungen über das Hautleistensystem der Polen*, *Zeitschr. für Morph. u. Anthropol.*, Bd. XIII, 1911.

hands, together with a low percentage of the hypothenar, when compared with the whites. The frequency of certain palmar formulæ in a given race, such as the formula 7.5.5.5 among the negroes, was also noted. It thus seemed that racial distinctions were certainly shown in the palm and sole markings, yet that the individual variation was so great in each race that only the averages of large numbers of individuals were of value as racial criteria. This view concerning the wide range of individual variations in all races became further corroborated as the St Louis Exposition furnished the opportunity of collecting prints from a number of human races not yet examined in this particular, and gave me the opportunity of studying and comparing both palm and sole prints of Ainus, Igorrotes, Patagonians, and Batua pigmies. These prints were taken for me by Mr Charles Hurlbut, and when added to my collection, which already contained the prints of negroes, Mayas, and Chinese, in addition to those of several hundred white Americans, presented material of sufficient breadth racially to allow of some generalization. Taken individually, there was nothing racially specific in either of these; not a palm or sole print but could be closely matched in its general features, except, of course, in the details of the ridges (Galton's *minutiæ*), by prints taken from Smith College students; yet, there still remained indications of definite racial differences in the percentage of occurrence of the several features, when compiled from a sufficiently large collection (at least 25 individuals).

There has just now come to my hand an unusually good opportunity for continuing these studies. Professor Frederick Starr, in his recent expedition to Liberia (1912), collected the palm and sole prints of 100 native soldiers, and, upon his return, presented the entire set to me. If, to appreciate this gift, one should take the complete set of prints of a single individual, and then multiply this effort by 100, he would estimate the work involved only in part, and should consider, in addition to this, the personal whims and caprices of each one of the hundred, and the task and skill required on the part of the collector in persuading them to submit to the process. Only thus may one appreciate the value of this gift, and

it is largely for him who has thus labored in my behalf that I am pleased, in presenting these data, that they show definite and positive results, of real value to anthropology.

The 100 individuals in this set are members of 13 different tribes, of which three are in Sierra Leone, the remaining ten Liberian. These, with their distribution among the hundred, which are numbered consecutively and are thus indicated in Tables I and II, are as follows:

Liberia

Buzi.....	Nos. 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 15, 16, 18, 19, 20, 24, 25, 26, 29, 31, 33, 34, 36, 37, 38, 47, 52, 54, 59, 61, 62, 66, 67, 70, 74, 81, 85, 86, 87, 88, 90, 93, 97; = 43.
Mpessi (= Kpwesi).....	Nos. 21, 72; = 2.
Bele (= Mbele).....	Nos. 11, 22, 40, 84, 89, 94; = 6.
Mandingo.....	Nos. 1, 4, 55, 58; = 4.
Bande (= Komende).....	Nos. 23, 39, 45, 49, 60, 71, 75, 78, 79, 80, 91, 92, 95, 98; = 14.
Gola (= Gora).....	Nos. 41, 65; = 2.
Bassa.....	Nos. 17, 82; = 2.
Kisi.....	Nos. 56, 57; = 2.
Grebo.....	No. 83; = 1.
Lemba.....	No. 27; = 1.

Sierra Leone

Mende.....	Nos. 14, 30, 32, 35, 42, 43, 44, 46, 48, 50, 51, 53, 64, 68, 69, 73, 76, 77, 96, 99, 100, = 21.
Temne.....	No. 63; = 1.
Susu.....	No. 28; = 1.

II. HANDS

The first cursory inspection of the prints of the hands showed an astonishing percentage of occurrence of the formula 7.5.5.5, with the slight variations 7.5.5.3 and 7.5.5.4, a condition previously observed in the prints of American negroes, and of so frequent an appearance that I had come to regard it as the "negro formula." In this type (fig. 30) line D makes an abrupt upward curve, almost from its origin, and terminates between the little and ring fingers in the position designated by the figure 7. By this course the line in question necessarily embraces, and assists in the formation of, a definite looped or whorled pattern, morphologically the fourth

TABLE I
HAND FORMULÆ OF LIBERIAN NATIVES (MALES) COLLECTED BY
FREDERICK STARR, 1912

No.	Left	Right	No.	Left	Right
1	7.5.5.3 th.o	— . — .5.5 o.o	51	— . — .5.5 th.o	— . — . — . — o.o
2	7.5.5.5 o.o	7.9.5.5 o.o	52	7.5.5.5 o.o	8.6.5.5 o.o
3	7(5).5.5 —.o	7.5.5.5 th.h	53	T⁹.7.5.5 th.o	10.9.6.5 th.o
4	7.5.5.5 th.o	— . — . — .5 th.o	54	7.5.5.3 o.o	7.5.5.5 o.o
5	7.5.5.3 o.o	7.5.5.3 o.o	55	7.5.5.5 o.o	7.5.5.5 o.o
6	— . — . — .5 o.h	— . — .5.5 o.o	56	7.5.5.3 o.o	7.5.5.5 o.o
7	7.5.5.4 o.h	7. — .5.4 o.h	57	7.5.5.3 o.o	7.7.5.5 o.o
8	7.5.5.3 o.o	9. — .5.5 o.o	58	7.5.5.4 o.h	11.8.7.5 o.h
9	7. — .5.5 o.o	— . — . — .5 o.o	59	7.5.5.5 o.h	7.5.5.5 o.o'
10	9.7.5.5 o.o	11.9.7.5 o.o	60	— . — . — .5 th.o	11.9.7.5 th.o
11	7.7.5.5 th.o	7.9.5.5 th.o	61	7. — .5.3 o.o	7.9.5.5 o.o
12	9.8.5.5 th.o	11.9.7.5 th.h	62	7.7.5.5 o.o	7.9.5.5 o.o
13	9.7.5.4 o.h	9.7.5.5 o.o'	63	7.5.5.5 o.o'	— . — .5.5 o.o
14	7.5.5.3 o.o	— . — .5.5 o.o	64	9.7.5.5 o.o'	9.8.5.5 o.o'
15	7. — . — .5 o.h	11. — . — .5 o.h	65	9.7.5.5 o.o	11.9. — .5 o.h
16	7.5.5.3 o.o'	8.6.5.5 o.o	66	T⁹.8.5.5 o.o	7.9.5.5 o.o
17	9.8.5.5 o.o	— . — . — . — o.o	67	T⁹.7.5.5 o.h	— . — . — .5 o.h
18	7.5.5.3 o.o	7.5.5.3 o.o	68	7.5.5.5 o.o	— . — .5.5 o.o
19	9.8.7.5 o.h	11.9.7.5 o.h	69	7. — .5.5 o.o	7. — .5.5 o.o
20	9.7.5.5 o.o	9. — .5.5 o.o	70	T⁹.7.5.5 o.o	9.7.5.5 o.o
21	7.5.5.5 o.o	— . — .5.5 o.o	71	7.9.5.5 th.o	T⁹.9.5.5 th.o
22	7.5.5.3 th.o	8.6.5.5 o.o	72	— . — .5.3 o.o	— . — . — .5 o.o
23	9.7.5.5 o.o	11.9.7.5 o.o	73	7.5.5.3 o.o'	— . — . — .5 o.o
24	7.8.5.5 o.o	— . — . — . — o.o	74	7.5.5.5 o.o	— . — . — .4 o.h
25	— . — .5.5 o.o	— . — .5.5 o.o	75	9.8.5.5 o.o	7.7.5.5 o.o
26	9.7.5.5 o.o	— . — . — .5 o.o	76	— . — . — . — o.o	— . — . — .5 o.o
27	7.5.5.3 th.o	7.5.5.5 o.h	77	7. — .5.5 th.h	11.9.7.5 o.o
28	7.5.5.3 o.o	7.5.5.5 o.o'	78	T⁹.7.5.3 o.o	11.9.7.5 o.o
29	T⁹.9.5.5 th.o	— . — . — . — o.h	79	7.5.5.3 o.h	7.5.5.5 o.o
30	7.5.5.3 o.h	— . — .5.5 o.o	80	7.5.5.5 o.o	— . — .5.3 o.o
31	9.7.5.5 o.o	— . — . — .5 o.o	81	7. — . — .5 o.o	7. — . — .5 o.o
32	7.5.5.5 th.o	7.5.5.5 o.o	82	7.7.5.5 o.o	11.9.7.5 o.o
33	7.5.5.5 o.o	— . — .5.5 th.o	83	7.5.5.3 o.o	10. — .6.5 o.h
34	— . — . — . — o. —	— . — . — . — o. —	84	7.5.5.3 o.o	— . — . — .5 o.o
35	7.7.5.5 th.h	T⁹.9.5.5 th.h	85	— . — .5.4 o.h	7. — . — .5 o.h
36	T¹⁰.9.6.5 th.o	7.9.5.5 o.o	86	— . — . — .5 th.o	11. — .7.5 o.o
37	11.8.7.5 o.o	11.8.7.5 o.o	87	7. — .5.5 o.o	9.9.5.5 o.o
38	7.5.5.5 o.o	— . — . — . — o.o	88	7.5.5.5 o.o	7.5.5.5 o.o
39	9. — .5.5 th.h	— . — .5.5 o.o	89	7.5.5.3 o.o	— . — .5.5 o.o
40	7.9.5.5 th.o	— . — .5.5 o.h	90	7.5.5.3 o.o	— . — .5.3 o.o
41	7.5.5.5 o.o	— . — .5.5 o.h	91	7.5.5.3 o.o	— . — .5.5 o.o
42	7.5.5.5 o.o'	— . — . — .5 o.o	92	7. — .5.5 o.o	— . — . — .5 o.o
43	— . — .5.5 o.o	11. — . — .5 o.o	93	— . — .5.5 th.o	— . — .5.5 o.o
44	— . — .5.5 o.o'	— . — . — .5 o.o	94	— . — . — .3 o.o'	— . — . — .5 o.h
45	7.5.5.5 o.o'	7.5.5.5 o.o	95	7.5.5.5 o.o	— . — .5.5 o.o
46	T⁹. — .5.3 o.o	— . — .5.5 o.o	96	7. — .5.3 o.o'	— . — .5.5 o.o
47	— .5.5.5 th.o	— . — .5.5 th.o	97	7.5.5.5 o.o	7. — .5.5 o.o
48	9.7.5.5 o.o	11.9.7.5 o.o	98	7. — .5.5 o.o	7.5.5.3 o.o
49	7. — .5.5 o.h	— . — . — . — o.o	99	7.5.5.3 o.o	7. — . — .3 o.o
50	11.9.7.5 o.o	11.9.7.5 o.o	100	— . — .5.4 o.h	— . — .5.5 o.o

Only the formulæ in bold-faced type are complete and beyond doubt correct, and the conclusions given in this paper are based on these alone. The others, 99 in num-

interdigital of Miss Whipple.¹ The three other main lines open upon the outer margin, sometimes with line A terminating along the

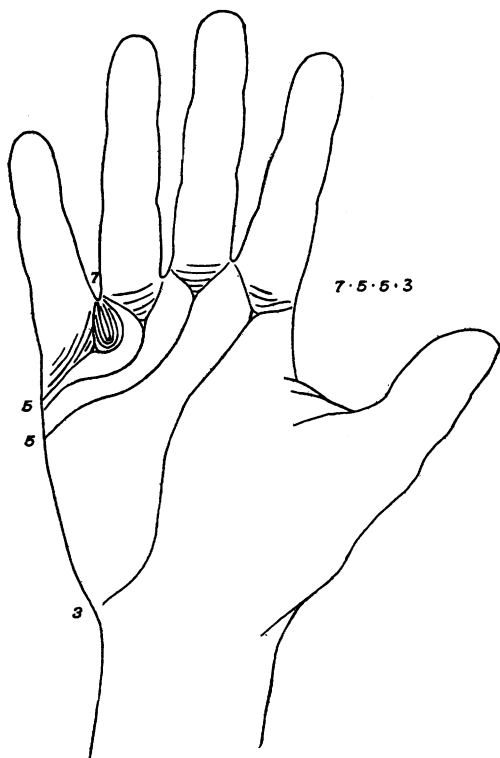


FIG. 30.—Typical print, showing the *negro formula*,
7 · 5 · 5 · 3. No. 5, Buzi tribe.

upper two-thirds of this margin, position 5, or within the lower, or proximal third, position 3. Occasionally, too, line A becomes involved in a hypothenar pattern, and is thus prevented from attaining the margin at all; position 4. Thus these three closely related formulæ are practically the same, the sole difference being in the course of line A. The finding of this “negro formula” so common in the Liberian prints, after having already established its frequency among North American negroes, is of especial significance, since the source of these new prints

is geographically so near the place of origin of the majority of the North American slaves.

The next step in the examination consisted naturally of making

ber, are either defective or, when complete, are more or less uncertain, owing to the condition of the print. The two last figures, those following the palmar formula, indicate the presence of a thenar pattern by *th*, an hypothenar by *h*, and the absence of a pattern by an *o*. An accented *o*, thus, *o'*, denotes a rudiment of the pattern in question.

¹ Whipple, Inez L., The Ventral Surface of the Mammalian Chiridium with special reference to the conditions found in Man, *Zeitschr. für Morphol. u. Anthropol.*, Bd. VII, 1904.

a definite formulation of the individual palms, and presenting the results in the form of a table (Table I). Unfortunately many of the prints were deficient in certain essential areas, especially along the bases of the fingers where the triradii of origin of the main lines are situated, and thus of the entire set I could be positive of the complete formulæ of but 64 left hands and 37 rights, 101 in all. These appear in the table in bold-faced type; in the other cases only the parts which could be definitely known are given.

As a basis for comparison 100 sets of hands from native whites from the United States were formulated in the same way and placed in a second table (Table II), but here, as I could select these from a collection of more than 400, it was possible to take only those that could be wholly formulated, and there are thus 200 complete formulæ, 100 from each side.¹ Although there has yet been found absolutely no difference between the sexes in respect to palm and sole marking, it may be noted that the Liberian prints were all males, and the prints of whites from my collection all females.

A mere glance at these two tables (I and II) will suffice to show certain distinct and well-marked differences, such as (1) that the great preponderance of the "negro formula" in the Liberians is a fact, and (2) that the amount of individual variation, as shown in the number of different formulæ represented in each set, is far greater in the whites than in the Liberians.

¹ These formulæ follow the method first proposed by me in a popular article in 1903 (*Pop. Sci. Monthly*, Sept.) and afterward brought to general use. It was explained in the paper just quoted, and again more thoroughly in 1904, in the paper in the *American Anthropologist* on racial differences. As in those papers, I still use the numeral 8 for cases of total suppression of line c, as well as for those in which there is a very short line that ends in a loop, although for the first of these cases Loth has proposed the sign x, which may prove convenient. This condition Loth considers a Polish character, but I have found this, as well as the very short line, in many races. These cases represent respectively the "arch" and the "tented arch" of Galton, and simply show the two final stages in the degeneracy of the pattern as shown by Miss Whipple (1904, loc. cit., fig. 44, p. 345, c. II, and d. III). These figures are cited by Loth, and the two conditions are figured by him in his *Tafel* IV, figs. 1 and 2. I am sorry that I have nowhere explained these cases, or my expressions for them in the written formulæ, for the omission has misled Loth; but the frequent use of the numeral 8 as the position of line c, as seen in my former papers, indicates the frequency of these conditions.

TABLE II

HAND FORMULÆ OF WHITE INHABITANTS OF THE UNITED STATES (FEMALES)
COLLECTED BY HARRIS HAWTHORNE WILDER

No.	Left		Right		No.	Left		Right	
1	8.6.5.1	o.o	9.9.5.5	o.o	51	T ¹¹ .9.7.5	o.h	11.10.8.5	o.h
2	10.7.6.2	o.o	11.9.7.5	o.o	52	11.8.7.5	o.h	11.9.7.5	o.o
3	9.7.5.3	o.o	10.9.6.4	o.h	53	9.8.5.5	th.o	10.7.6.5	o.o
4	10.9.6.2	o.o	11.9.7.2	o.o	54	T ⁹ .8.5.5	th.o	11.9.7.5	o'.o
5	11.10.8.5	o.h	11.10.8.5	o.h	55	10.7.8.3	o.o	9.7.5.5	o.o
6	10.9.6.5	o.h	10.7.6.5	o.o'	56	10.8.6.5	o.h	11.9.7.3	o.h
7	8.6.5.3	o.o	9.7.5.4	o.h	57	7.5.5.3	o.o	9.8.5.3	o.o
8	7.5.5.5	th.o	9.7.5.5	o'.o	58	11.7.7.5	o.o	11.9.7.5	o.o
9	10.7.6.3	o.o	11.9.7.5	o.o	59	11.8.7.5	o'.o	11.9.7.3	o.o
10	11.7.7.3	o.o	9.7.5.5	o.o	60	11.9.7.5	o.o	11.8.7.3	o.o
11	11.9.7.4	th.h	11.9.7.5	th.h	61	10.8.6.5	o.h	10.7.6.4	o.h
12	11.7.7.4	o.h	10.7.6.5	o.o	62	9.8.5.5	th.o	10.7.6.5	o'.o
13	9.8.5.5	th.o	11.10.8.5	o.o	63	9.7.5.3	o.h	11.9.7.4	o'.h
14	9.7.5.5	o.o	9.8.5.5	o.h	64	11.9.7.5	th.o'	11.9.7.5	th.o
15	9.7.7.5	o.o	11.8.7.5	o.o	65	11.8.7.5	o'.o	11.9.7.5	o.o
16	9.7.7.5	th.o	11.9.7.5	o'.o	66	11.8.7.5	o.o	11.8.7.5	o.o
17	10.9.6.2	o.h	10.9.6.5	o.o	67	8.6.5.5	o.o	9.7.5.5	o.o
18	7.7.5.5	o.o	7.5.5.5	o.o	68	11.9.7.5	o.o	11.9.7.5	o.o
19	10.7.6.5	o.o	11.9.7.5	o.o	69	11.8.7.5	th.o	11.9.7.5	th.h
20	7.5.5.3	o.o	9.7.5.5	o.o	70	9.7.5.3	o.o	9.7.5.4	o.h
21	10.7.6.5	o'.o	10.7.6.5	o.o	71	11.9.7.5	th.h	11.9.7.5	o.h
22	9.7.5.5	o.h	11.9.7.5	o.h	72	10.7.6.5	o.o	11.9.7.5	o.h
23	11.9.7.5	th.o	11.10.8.5	th.o	73	9.7.5.3	o.o	9.7.5.5	o.h
24	7.5.5.4	o.h	11.7.7.5	o.o	74	11.9.7.5	o.o	11.9.7.5	o.h
25	7.5.5.2	o.h	8.6.5.5	o.h	75	11.9.7.5	th.o	11.9.7.5	o.o
26	8.6.5.3	o.o	7.5.5.3	o.o	76	10.9.6.3	o.o	9.7.5.5	o.o
27	9.7.5.4	o.h	9.7.5.4	o.h	77	9.9.5.5	o.o	10.8.6.5	o.o
28	7.5.5.4	o.h	7.5.5.4	o.h	78	9.7.7.5	o.h	11.9.7.5	o.h
29	9.7.5.5	o.o	9.7.5.5	o.o	79	9.7.5.3	o.h	10.9.6.5	o.h
30	9.7.7.4	o.h	10.7.6.5	o.o	80	11.8.7.5	th.o	11.9.7.5	th.o
31	10.7.6.2	o.h	11.9.7.4	o.h	81	10.7.6.5	o.o	7.5.5.5	o.o
32	7.5.5.3	o.o'	9.7.5.2	o.h	82	7.5.5.3	o.h	9.7.5.3	o.h
33	10.7.6.2	o'.h	9.7.5.3	o.o	83	11.9.7.5	o.o	11.9.7.5	o.o
34	T ⁹ .8.7.5	th.o	T ¹¹ .10.8.5	o.o	84	11.7.7.5	o.h	11.7.7.5	o.h
35	9.7.5.5	o.o	9.7.5.5	o.o	85	11.9.7.5	o.o	11.9.7.5	o.o
36	11.7.7.3	o.h	11.7.7.5	o.o	86	10.9.6.5	o.h	10.9.6.5	o.o
37	11.9.7.5	o.h	11.9.7.5	o.o'	87	9.7.5.5	o.o	10.9.6.5	o.o
38	8.6.5.3	o.o'	8.6.5.4	o.h	88	9.7.5.5	th.o	7.5.5.5	o.h
39	7.8.5.3	o.h	7.9.5.4	o.h	89	11.9.7.5	o.o	T ¹¹ .9.7.5	o.o
40	9.8.7.5	o.h	11.9.7.5	o.o	90	9.9.5.5	o.h	11.9.7.5	o.h
41	9.7.5.3	o.o	7.5.5.5	o.h	91	7.9.5.4	o.h	11.10.8.5	o.o
42	11.8.7.5	o.o	10.9.6.5	o.o	92	7.5.5.5	o'.o	11.9.7.5	o.o
43	11.7.7.5	o.o	11.9.7.5	o.h	93	7.5.5.5	o.o	7.5.5.5	o.o
44	9.7.5.2	o.h	9.7.5.5	o.h	94	T ¹¹ .9.7.5	o.o	7.9.5.5	o.o
45	11.9.7.5	th.o	11.8.7.5	th.o	95	11.9.7.5	o'.o	11.9.7.5	o.o
46	7.5.3.2	o.o	8.6.5.3	o.o	96	10.9.6.1	o.o	9.7.5.5	o.o
47	9.9.5.5	o'.o	9.7.5.5	o.o	97	9.7.5.3	o.o	11.7.7.3	o.o
48	7.5.5.3	o.o	8.6.5.5	o.o	98	11.8.7.5	o.o	11.10.8.5	o.o
49	10.9.6.3	o.h	9.7.5.5	o.h	99	11.7.7.5	o.h	11.9.7.5	o.o
50	7.5.5.2	o.o'	7.5.5.4	o.h	100	9.9.5.5	o.o	11.9.7.3	o.o

As this table has been made up from selected prints, in which all the designations are clear and definite, the use of bold-faced type, as in Table I, is not necessary.

To study these and other points in detail a table may be compiled, as in Table III, in which all the formulæ represented by both sets are collected and placed in numerical order, and followed

TABLE III
OCCURRENCE OF FORMULÆ IN THE TWO SETS OF PALM PRINTS

Formulæ	Whites			Negroes		
	Left	Right	Total	Left	Right	Total
7.5.3.2	1	—	1	—	—	—
7.5.5.2	2	—	2	—	—	—
7.5.5.3	5	1	6	18	3	21
7.5.5.4	2	2	4	2	—	2
7.5.5.5	3	5	8	18	11	29
7.7.5.5	1	—	1	4	2	6
7.8.5.5	1	—	1	1	—	1
7.9.5.4	1	1	2	—	—	—
7.9.5.5	—	1	1	2	5	7
8.6.5.1	1	—	1	—	—	—
8.6.5.3	3	1	4	—	—	—
8.6.5.4	—	1	1	—	—	—
8.6.5.5	1	2	3	—	3	3
9.7.5.2	1	1	2	—	—	—
9.7.5.3	7	2	9	1	—	1
9.7.5.4	1	3	4	1	—	1
9.7.5.5	6	13	19	11	1	12
9.7.7.4	1	—	1	—	—	—
9.7.7.5	3	—	3	—	—	—
9.8.5.3	—	1	1	—	—	—
9.8.5.5	4	1	5	2	—	2
9.8.7.5	2	—	2	1	1	2
9.9.5.5	4	1	5	1	3	4
10.7.6.2	3	—	3	—	—	—
10.7.6.3	1	—	1	—	—	—
10.7.6.4	—	1	1	—	—	—
10.7.6.5	4	6	10	—	—	—
10.7.8.3	1	—	1	—	—	—
10.8.6.5	2	1	3	—	—	—
10.9.6.1	1	—	1	—	—	—
10.9.6.2	2	—	2	—	—	—
10.9.6.3	2	—	2	—	—	—
10.9.6.4	—	1	1	—	—	—
10.9.6.5	2	5	7	1	1	2
11.7.7.3	2	1	3	—	—	—
11.7.7.4	1	—	1	—	—	—
11.7.7.5	4	3	7	—	—	—
11.8.7.3	—	1	1	—	—	—
11.8.7.5	8	3	11	1	2	3
11.9.7.2	—	1	1	—	—	—
11.9.7.3	—	3	3	—	—	—
11.9.7.4	1	2	3	—	—	—
11.9.7.5	15	29	44	—	5	5
11.10.8.5	1	7	8	—	—	—
Totals	100	100	200	64	37	101

each by the number of times it occurs in the two sets. In the whites, with exactly 200 hands, the percentage of occurrence of each formula is easily obtained by dividing the third, or "total," column by 2; in the negroes the corresponding third column gives practically the percentage without division, since the number of prints used happened to be 101 in number.

By the help of this table we are now ready to draw the following definite conclusions:

I. In the negro hands 52 per cent. show the typical "negro formula," 7.5.5.3-5. In the white hands this appears in only 10 per cent.

In the white hands 63 per cent. show the formula 11.9.7.2-5 (with the slight variation of 8 for 9 in the second place), a formula which may be called provisionally the "white formula." In the negro hands this appears in only 8 per cent.

II. The white hands exhibit no fewer than 44 different formulæ, while the negro hands show but 16. It must be admitted that the negro hands used here were but 101 in number against 200 of the whites, yet this would hardly account for the extraordinary difference. Furthermore, the 99 remaining formulæ, rejected because incomplete or indistinct, seem, so far as indicated, to be about like the others.

III. If we compare the first figure of the formulæ, which expresses the course of line D, it is found that in the negro hands this line terminates at 7, that is, in the interval between the little and ring fingers, in no less than 66 per cent. of the cases, practically two-thirds; while in the 200 white hands this course is seen in only 26 cases, or 13 per cent. This is shown in another way by noting that in Table III nearly all of the negro hands occur in the first third of the list, while the majority of the white hands are found in the last third. That these represent fundamental morphological differences, and

TABLE IV
PERCENTAGES OF THE VARIOUS TERMINAL POSITIONS OF LINE D

Terminal position of D	7	8	9	10	11	Total
Negroes.....	66	3	22	2	8	101 ¹
Whites.....	13	4.3	25.5	16	41	100

¹ Here, as elsewhere, the number of cases out of a total of 101 is employed instead of the exact percentage, as the two are practically the same.

undoubtedly also physiological ones, i. e., difference in the use of the hands, in the two races considered, is evident.

This difference in the course of line D may be shown in still another way, and perhaps more strikingly, by tabulating the terminal position of the line in question in all the cases here considered. (Table IV.)

IV. In the negro hands a fourth interdigital pattern is present, not only in the 66 cases where line D terminates at position 7; but in 21 other cases out of the 101, that is, in 87 per cent. In the white hands this pattern is not especially common, 55 cases in 200, or 27.5 per cent. This condition will be seen to be mainly a concomitant of the other features, closely correlated, for instance, with position 7 for line D, and is thus of minor importance as a distinctive character, yet serving to emphasize the differences previously noted.

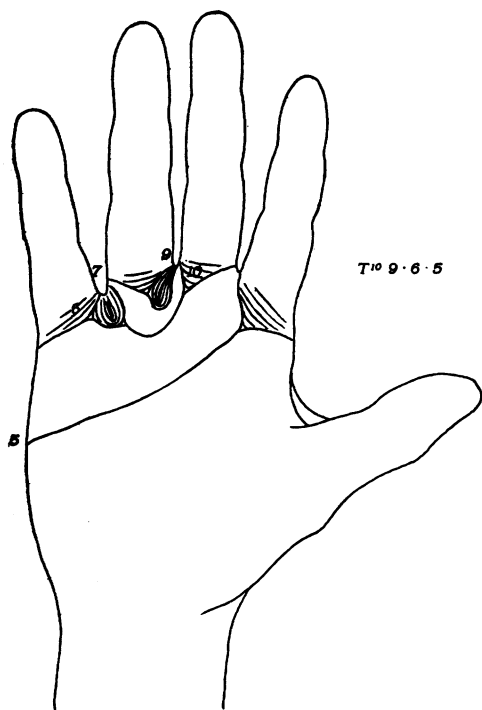


FIG. 31.—Print with a lower triradius present, and intercepting line D. This line is continued as the inner lower radiant of the triradius, and curves upward to position 10, cutting off line C from the outer margin. No. 36, Buzi tribe.

In counting the fourth interdigital pattern great care must be taken not to confound it with the "false pattern" (Miss Whipple) often found in the interval between the triradii of origin of lines C and D, and caused by the bending back of line C in a short curve to its ulnar rather than to its more usual radial side, in order to get out of the way either of the D line, when it reaches to termination 9 or beyond, or of a similar curve formed by the radiants of a lower triradius [cf. figs. 31 and 32]. The false pattern seen in the latter of

the two figures occupies nearly the same position as the true fourth interdigital, but the two often occur simultaneously (figs. 32 and 33) and are thus distinct. Occasionally, too, the true fourth interdigital has disappeared, and in such a case a large false pattern may greatly resemble the other. Various stages in this gradual reduction of the fourth interdigital pattern may be followed through figures 33, 32, and 34, in the order given, and in the last is seen a curious forking of the ridges which represents the last vestige of the pattern.

The lower triradius, too, which in the negro hands, in correlation with the fourth interdigital pattern, is of especially frequent occurrence, proves often a disturbing

element, and is illustrated in some of its phases in the figures. Often, as in figure 31, it intercepts line D directly, so that the latter may be said to terminate in it. It is also possible to consider line D as continuing along one of the other radiants of the triradius, in this case either continued along the most natural direction to 10, or curving sharply up to position 7. Here in all such cases the practice has been to indicate the terminus of line D by a capital T, indicating the direct collision with the triradius, and to indicate further the continuance on the other side of the triradius by an exponent, here T¹⁰. In figure 32 the same relation to the triradius, but with a different ultimate termination, gives the figure T⁹. It is plain

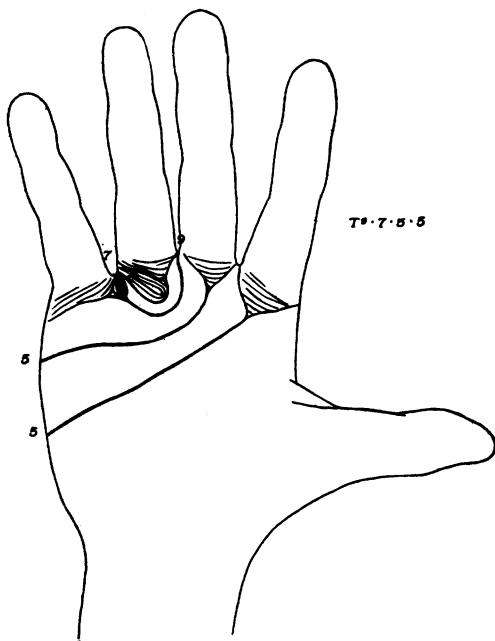


FIG. 32.—Case similar to fig. 31, but with line c curving around to the outer instead of the more normal inner side, forming a false pattern. No. 64, Mende tribe.

that these two cases, and others like them, might with an almost equal right be designated with simply the number 7; but while this is usually obvious, as in figure 31, in the rarer case shown in figure 32, the small size of the pattern and the direct continuance of the radiant to terminus 9 renders this latter the more obvious designation to use. In the conclusions given above, these cases with an interrupting triradius have not been included in the formulæ beginning with a 7, but if they had they might have made a slight difference in the percentages of the positions of line D.

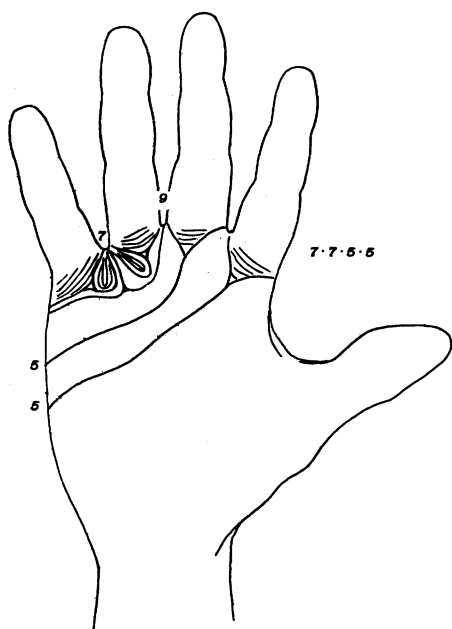


FIG. 33.—Case with the lower triradius below the D line, and so enclosing both this and line C that they make short curves and terminate interdigitally. The pattern formed by line C is false, as in fig. 32. No. 35, Mende tribe.

tion to use. In the conclusions given above, these cases with an interrupting triradius have not been included in the formulæ beginning with a 7, but if they had they might have made a slight difference in the percentages of the positions of line D.

In the 200 white hands are found 16 thenar patterns in the lefts and 6 in the rights, 22 in all, which give for this pattern a percentage of occurrence of 11 per cent. In the same number of negro hands, for these portions were decipherable in practically all the prints, there are 20 lefts and 10 rights, or 30 in all,

which give a percentage of 15 per cent. In this feature, then, there is but a slight advantage in favor of the negro, but it is to be noted that in this set of 100 whites the percentage is considerably larger than in the one previously investigated.

As for hypothenar patterns the whites give 33 lefts and 34 rights, or 33.5 per cent., while in the negroes the corresponding figures are 16 and 17, or 16.5 per cent. These figures show, then, a real racial difference in the occurrence of this pattern, and corroborate the feeling expressed tentatively in my previous paper that the

hypothenar was especially characteristic of the whites. It may also be noted that in each of the two cases the occurrence of this pattern was the same on the two sides, while in each the thenar occurs at least twice as frequently upon left hands.

Both hands of No. 71, a Bele negro, present strongly developed thenars, of a more primitive type than any I have ever seen. They consist of large whorls, with a slight tendency to form spirals, occupying the larger part of the thenar eminence. The one on the right hand (fig. 35), in which the print is more complete, shows also, above the thenar, the first interdigital pattern generally associated with the thenar, and between the two are the two triradii commonly found. The large triradius below the thenar pattern is seldom as definite as here, but has more usually disappeared within the core of the pattern, converting the whole into an open loop. Here its completeness, together with its distance from the center of the pattern, define for the latter a large area, within which the ridges become disposed in the typical primitive form of a concentric whorl. How primitive this case really is may be seen by comparing it with figure 36, which exhibits an extremely primitive thenar of the kind hitherto known.

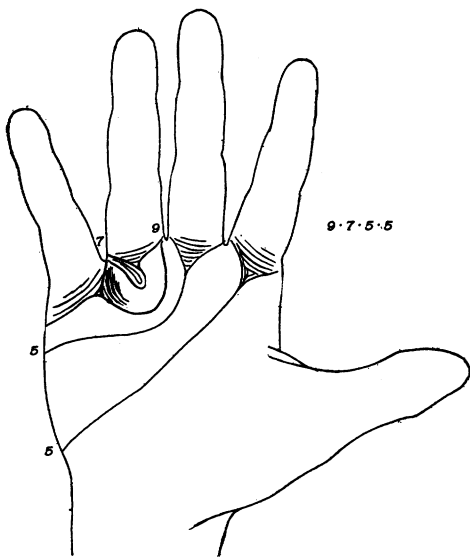


FIG. 34.—Case similar to fig. 32, but with the true fourth interdigital patterns reduced to a few vestiges. No. 65, *Golah* tribe.

A cursory examination of the finger-tips (apical patterns) show a considerable proportion of very large patterns, either loops or whorls, in which so many ridges enter into the formation of the pattern that the two triradii characteristic of these patterns are pushed very far around the sides of the finger and may in

some cases have been extralimital, that is, beyond the limits of the

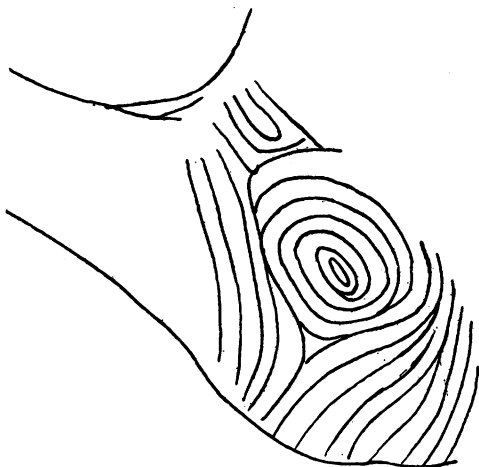


FIG. 35.—Primitive thenar pattern, combined with the first interdigital. No. 71, *Bande tribe*.

friction skin. Thus in the case of a loop the appearance is given at first glance of a finger ball covered with an unbroken series of longitudinal lines, somewhat resembling the typical lemurine condition, but of course in reality not so. The whorl, on the other hand, is really simian, and when of oval form and covering the whole of the finger, pre-

sents a true primitive condition. A few of the best of these, illustrating both principles, are given here for general study (fig. 37), but no detailed investigation of these parts has been attempted.

III. FEET

The sole prints have as yet been submitted to merely a cursory examination, in which a few points only have been noted. Naturally the first attention was directed to the hallucal pattern, which is by far the most conspicuous feature and is very variable. Everywhere the two commonest main types, or classes, are those previously designated as types A and W, the one a

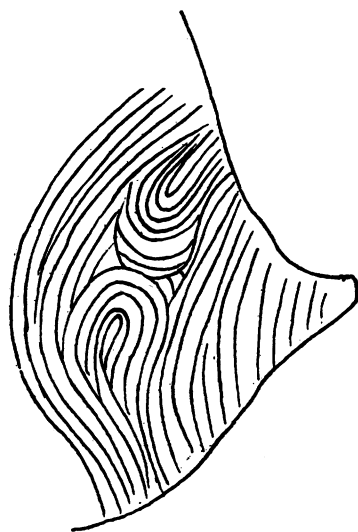


FIG. 36.—Well-developed thenar pattern, combined with the first interdigital, from a white woman from the United States. This represents about the highest development of the thenar pattern yet reported from the white race. For comparison with fig. 35. H. H. W. Coll., No. 8.

simple loop opening upward between hallux and second toe, the other a whorl or a complex figure closely approaching it. Aside from these are the loop opening to the inner margin, type B, and the large spiral, denoted as S, together with certain forms hard to define, and expressed by such combinations as AB, etc.

The A-type of hallucal pattern, especially when joined with a sole otherwise patternless, and covered by ridges that run across the entire ball obliquely from this base of the lesser digits toward the inner side below the ball, seems especially characteristic of the white race. On the other hand, the whorl, combined with several other well-defined patterns, especially the outer one (fourth interdigital), and with a large and pronounced lower triradius at about the meeting place of the three outer interdigital patterns, seems to be more common among primitive races. The frequency of this type of sole among the Maya has been already noted, and is figured in my previous paper on this subject.¹ While, now, the presence of either the A-type or the w-type in a given foot does not necessarily indicate that the

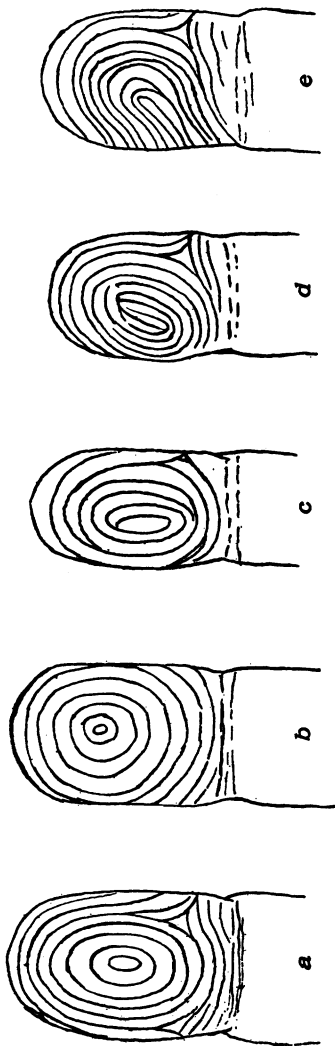


FIG. 37.—A number of primitive apical patterns from the Liberian prints. (a) Right annularis of No. 40, *Bele*. (b) Left medius of No. 43, *Mende*. (c) Left annularis of No. 75, *Bende*. (d) Left minimus of No. 45, *Bende*. (e) Left minimus of No. 64, *Mende*.

¹ Loc. cit., 1904, fig. 5, p. 267.

foot is typical throughout, the A without patterns, and the w well supplied, such is usually the case, and thus a comparison of the percentage of occurrence of the two in whites and Liberians will be of interest. For comparison I have used the sole prints of 84 white individuals from the United States (168 separate soles); of the Liberians I have the complete set (100 individuals, 200 sole prints), as all are sufficiently legible for use.

In the whites the A-type of hallual pattern appears in 39 lefts and 46 rights, in all 85, which gives a percentage of 50.5. In the Liberians the corresponding figures are but 21, 27, and 48, or

24 per cent. less than half that of the whites. On the other hand the w-type occurs in the white feet in only 32 lefts and 26 rights, or 58 in all, giving a percentage of 34.5; while in the blacks the figures are 54 for each side, or 108 in all; that is, 54 per cent. This, then, is a further corroboration of the previous statements concerning these types, that type A is especially characteristic of the white race, and the type w is more frequent elsewhere.

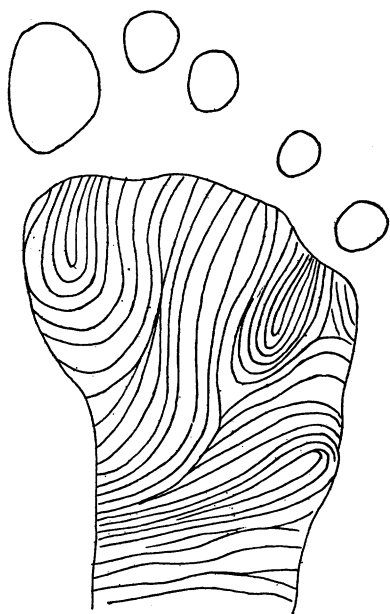


FIG. 38.—Right sole of No. 88, Buzi, with suggestions of simian characteristics.

of such as against 14.9 per cent. Of these forms the B-type appears in excess in both races, as is natural, while, again in both races, certain individual soles are occasionally found which are difficult to explain, and hence to classify.¹ Thus, the hallual pattern

¹ Even in the small number of cases then at my disposal I had noted these variations of the hallual pattern in the negro in my paper of 1904, and there figured two of them (pl. XI), one a case in which the pattern had practically disappeared, the other the B-type. These two are frequent and noticeable in the Liberians.

may entirely disappear, and the surface be covered by a course of nearly parallel ridges, usually with a single triradius in some part of it to mark the former condition.

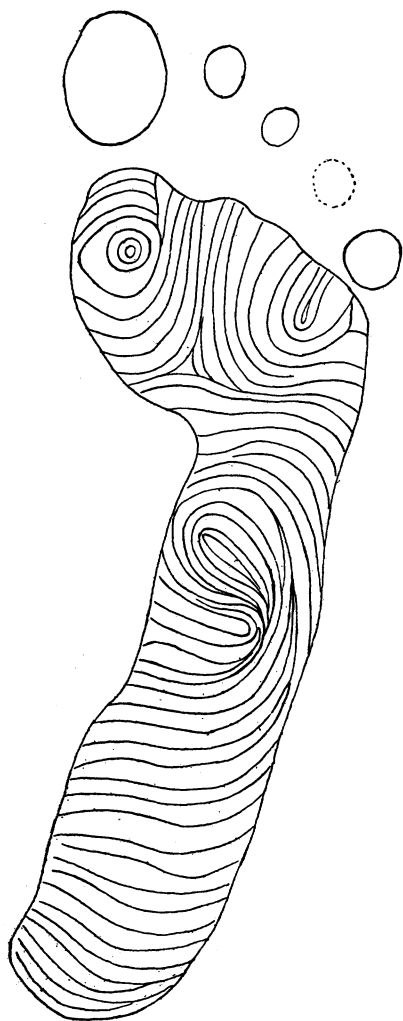


FIG. 39.—Right sole of No. 85, Buzi, showing a large S-shaped pattern of unknown morphological significance in the middle third.

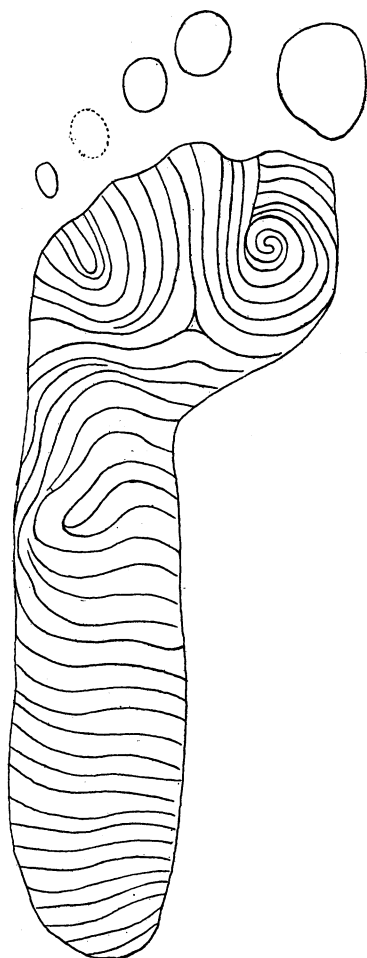


FIG. 40.—Left sole of the same, with a similar pattern, although less complicated.

In general it may be said that among the Liberian set occur several very unusual prints, that give unexpected arrangements, not previously noted anywhere. Two or three, for example, exhibit an almost longitudinal course of the ridges over an extent equal to at least the distal third of the entire sole, like the one shown in figure 38; yet a similar condition has been noted in whites, the main difference being in the proportionate length of the area thus occupied, a character hard to determine. This character is, however, an extremely important one morphologically, since a similar but more extensive longitudinal course of the ridges is the rule among the large simians, probably to counteract the tendency of the foot to slip sideways when applied to the side of a horizontally placed limb.

Altogether the most singular pair of feet belong to a Buzi by the name of Kasugua, No. 85 of the Starr collection, and, for their very unlikeness to anything I have ever seen, are reproduced here (figs. 39 and 40). In this an enormous loop, or more probably, as better indicated in the right foot, a widely extended S, occupies the entire middle third of the foot. Whether this may prove to be a true thenar, usually suppressed, or whether it may be eventually brought into line with the single hypothenar loop, which is of frequent occurrence everywhere, especially in the whites, or perhaps with the rare calcar loop noted in a few whites (Miss Whipple, 1904, loc. cit., pl. VI), cannot yet be even speculated upon; but these ideas may here be suggested, while hoping and waiting for points that may some day furnish a clue to the matter.

In this connection is it too much to hope for the discovery of prints, both of hands and feet, in the clay of European caverns which have been the site of prehistoric activity? Neolithic fingerprints on shards have often been reported, although, I think, never studied by an expert on the subject, and very recently there has been mention of the discovery of footprints in the clay in association with paleolithic wall paintings of the Pyrenees and adjacent territories (*L'Anthropologie*). As we have now many careful studies of the palm and sole prints of our large anthropoids, and are continually increasing our knowledge of the subject in the

case of numerous human types, even a slight indication of such a print, made by paleolithic man, might give invaluable data concerning the evolution of this portion of our anatomy.

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NORTHAMPTON, MASSACHUSETTS